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SOYBEAN Vs. ALFALFA HAY FOR MILK PRODUCTION

Soybeans, the West Virginia Legume.

BY
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Soybean Vs. Alfalfa Hay For Milk Production

Alfalfa has long been recognized as one of the best forage crops for milk production. It is a legume, high in protein and mineral matter. It is palatable, and has a very beneficial effect upon the digestive system of the cow. For these reasons alfalfa has become very popular where it can grown to advantage.

On much of the land in West Virginia, because of the type and condition of the soil, alfalfa cannot be grown economically. A satisfactory substitute, however, is found in the soybean which can be grown under less favorable soil conditions. The soybean is but little affected by many of the conditions which interfere with the growth of alfalfa. Analysis shows the soybean to be high in protein and in mineral matter, but just how it compares with alfalfa in feeding value for milk production has not hitherto been definitely determined. Many dairymen have, however, used it with very satisfactory results.

In order to ascertain how the soybean compares with alfalfa as a feed for the production of milk, the following experiment was planned in which soybean hay was to be fed in comparison with alfalfa hay.

THE PLAN OF THE EXPERIMENT

Ten cows were divided into two lots of five each. The groups were carefully selected and balanced against each other as to milk production, percent of butterfat, weight of cow, and length of lactation period. The plan was not to compare the two lots, but rather to compare two feeding periods of the same lot, using one lot as a check against the other.

Each lot was fed a basal ration consisting of corn silage and a grain mixture. The silage was fed at the rate of 30 pounds to each 1,000 pounds live weight of the cows, and the grain was fed at the rate of approximately one pound of grain for each three and one-half pounds of milk produced. The grain mixture in the first trial consisted of 200 pounds ground barley, 200 pounds corn meal, 400

pounds wheat bran, and 100 pounds cottonseed meal. During the second trial, the mixture consisted of 200 pounds wheat bran, 100 pounds wheat middlings, 100 pounds corn meal, 100 pounds gluten meal, and 50 pounds cottonseed meal.

During the first period, Lot 1 was fed, in addition to the grain and silage, 10 pounds of alfalfa hay per day; and Lot 2 was fed 10 pounds of soybean hay per day. During the second period, Lot 1 was fed soybean hay and Lot 2 was fed alfalfa hay. The two lots of cows were fed and handled in exactly the same way except that they were given the different kinds of hay. The alfalfa hay used was "Choice Michigan Second Cut" in both trials. The soybean hay was home grown of the variety Wilson.*

*The soybean varieties best adapted to West Virginia conditions and their cultural methods are fully discussed in West Virginia Experiment Station Bulletin 172.

THE COWS AT BEGINNING OF FIRST TRIAL

Tables I and II show the breed, weight, date of freshening, and milk production of the two lots at the beginning of the experiment.

TABLE I.—Data on Cows Later Used in First Feeding Trial

Lot 1:

Herd No. of Cow	Breed	Date of Freshening	Lbs. Daily Milk Production	Weight of Cows in Lbs.
10	Jersey	Oct. 21, 1919	35.1	878
22	Holstein	Aug. 18, 1919	26.8	881
11	Holstein	May 2, 1919	16.2	1386
16	Holstein	Oct. 15, 1919	51.3	1260
13	Holstein	Aug. 25, 1919	20.7	1256
		Average	**30.0**	**1132**

Lot 2:

9	Holstein	Oct. 9, 1919	30.6	1412
14	Jersey	Sept. 19, 1919	16.7	915
7	Ayrshire	July 11, 1919	35.1	1140
6	Holstein	Sept. 8, 1919	47.5	1280
21	Holstein	Dec. 15, 1919	41.0	993
		Average	**34.2**	**1148**

TABLE II.—Data on Cows Later Used in Second Feeding Trial

Lot 1:

Herd No. of Cow	Breed	Date of Freshening	Lbs. Daily Milk Production	Weight of Cows in Lbs.
4	Holstein	Sept. 1, 1921	32.6	1437
34	Holstein	Oct. 20, 1921	40.9	1365
43	Ayrshire	Nov. 8, 1921	28.0	1015
47	Holstein	Aug. 28, 1921	22.8	1210
50	Guernsey	Sept. 24, 1921	19.9	995
		Average	**28.8**	**1204**

Lot 2:

14	Jersey	Nov. 30, 1921	31.0	940
16	Holstein	Sept. 11, 1921	31.7	1495
33	Holstein	Dec. 24, 1921	60.2	1190
36	Holstein	Nov. 14, 1921	22.8	1185
48	Holstein	Aug. 21, 1921	20.1	1085
		Average	**33.2**	**1179**

THE FIRST FEEDING TRIAL

The cows were fed for six weeks during which time records of the weight of milk were carefully kept and composite samples were taken. The samples were tested for butterfat by the Babcock method at weekly intervals. The cows in Lot 1 were fed for three weeks on alfalfa hay and then changed to soybean hay, while those in Lot 2 were fed soybean hay and after three weeks were changed to alfalfa hay. The cows were fed the ration one week before the beginning of each test period in order to accustom them to the change. The weight of each cow was taken at the beginning, between the first and second periods, and after the experiment had ended. The same plan was carried out in both experiments, with the exception of a change in the grain ration.

RESULTS OF THE FIRST FEEDING TRIAL

The first trial was started December 19, 1919. The cows in Lot 1 were fed alfalfa hay and the basal ration for three weeks, and were then changed to soybean hay and the same basal ration for a second three weeks. The cows in Lot 2 were fed soybean hay and the basal ration for three weeks, and were then changed to alfalfa hay and the basal ration for a second three weeks.

TABLE III.—Production of Cows in First Trial

Lot 1:

Herd No. of Cow	ALFALFA PERIOD			SOYBEAN PERIOD		
	Pounds of Milk	Percent of Butterfat	Total Lbs. of Butterfat	Pounds of Milk	Percent of Butterfat	Total Lbs. of Butterfat
10	559.4	5.45	30.46	448.6	5.76	25.86
22	540.3	3.73	20.16	567.9	4.00	22.72
11	294.2	3.81	11.20	292.5	4.55	13.32
16	970.7	2.97	28.82	964.1	3.20	30.85
13	320.3	3.42	10.94	323.3	3.37	10.90
Total	**2684.9**	**3.78**	**101.58**	**2596.4**	**3.99**	**103.65**

Lot 2:

	SOYBEAN PERIOD			ALFALFA PERIOD		
9	625.8	3.26	20.43	589.4	3.40	20.03
14	499.7	5.04	25.17	492.3	5.07	24.96
7	326.3	3.93	12.81	335.5	4.20	14.09
6	848.8	2.70	22.89	768.6	3.06	23.52
21	714.5	3.50	25.01	702.2	3.40	23.86
Total	**3015.1**	**3.53**	**106.31**	**2888.0**	**3.69**	**106.46**

TABLE IV.—Summary of Production in First Trial

Periods	Lbs. of Milk Produced	Percent of Butterfat	Total Lbs. of Butterfat
Soybean periods	5611.5	3.74	209.96
Alfalfa periods	5572.9	3.73	208.04
Difference in favor of soybean Periods	**38.6**		**1.92**

TABLE V.—Weights of Cows in First Trial

Lot 1:

Herd No. of Cows	Weight at Beginning of Test	Wt. at End of First Period	Gain (or Loss) in Wt. During First Period	Wt. at End of Second Period	Gain (or Loss) in Wt. During Second Period
10	878	895	17	930	35
22	882	895	13	930	35
11	1387	1350	−37	1350	00
16	1260	1250	−10	1240	−10
13	1256	1285	29	1310	25
Total	**5663**	**5675**	**12**	**5760**	**85**

Lot 2:

9	1413	1427	14	1430	3
14	919	845	−74	860	15
7	1137	1120	−17	1080	−40
6	1280	1310	30	1260	−50
21	993	945	−48	1000	55
Total	**5742**	**5647**	**−95**	**5630**	**−17**

TABLE VI.—Summary of Weights in First Trial

Periods	Wts. of Cows at Beginning	Wts. of Cows at End	Gain (or Loss in Wt.
Soybean periods	11417	11407	−10
Alfalfa periods	11310	11305	− 5
Difference in favor of alfalfa periods			5

Tables III, IV, V, and VI show that the five cows in Lot 1, while being fed alfalfa hay during a 21-day period, produced 2684.9 pounds of milk containing 101.58 pounds of butterfat; had an average butterfat test of 3.78 percent; and gained a total of 12 pounds in weight. The same five cows while being fed soybean hay during a 21-day period produced 2596.4 pounds of milk containing 103.65 pounds of butterfat; had an average butterfat test of 3.99 per cent; and gained a total of 85 pounds in weight.

The five cows in Lot 2, while being fed alfalfa hay during a 21-day period, produced 2888.0 pounds of milk containing 106.46 pounds of butterfat; had an average butterfat test of 3.69 percent; and lost a total of 17 pounds in weight. The same five cows while being fed soybean hay during a 21-day period produced 3015.1 pounds of milk and 106.31 pounds of fat; had an average butterfat test of 3.53 percent; and lost a total of 95 pounds.

Bringing together the results from both lots we find that the ten cows, while being fed alfalfa hay during a 21-day period produced 5572.9 pounds of milk which had an average butterfat test of 3.73 percent yielding 208.04 pounds of butterfat, and lost 5 pounds in weight. The same 10 cows, when fed soybean hay during a similar period produced 5611.5 pounds of milk, with a butterfat test of 3.74 percent, yielding 209.96 pounds of butterfat, and lost a total of 10 pounds in weight.

RESULTS OF SECOND FEEDING TRIAL

The second trial was started February 4, 1922, and after each group was fed seven days to accustom it to its ration, the cows in Lot 1 were fed alfalfa hay along with the basal ration and the cows in Lot 2 were fed soybean hay with the basal ration. After three weeks the lots were changed, and the one being fed alfalfa hay was then fed soybean hay and the one being fed soybean hay was then fed alfalfa hay exactly as in the first trial.

TABLE VII.—Production of Cows in Second Trial

Lot 1:

Herd No. of Cows	ALFALFA PERIOD			SOYBEAN PERIOD		
	Lbs. of Milk	Percent of Butterfat	Total Lbs. of Butterfat	Lbs. of Milk	Percent of Butterfat	Total Lbs. of Butterfat
50	393.1	4.52	17.77	359.6	4.54	16.34
4	626.2	3.22	20.18	611.1	3.45	21.08
34	854.4	2.96	25.28	874.4	2.95	25.79
43	540.7	3.91	21.15	488.6	3.96	19.37
47	485.2	3.55	17.24	469.3	3.42	16.06
Total	**2899.6**	**3.50**	**101.62**	**2803.0**	**3.52**	**98.64**

Lot 2:

	SOYBEAN PERIOD			ALFALFA PERIOD		
14	601.2	4.47	26.85	585.8	4.44	26.00
16	642.0	3.13	20.12	640.5	3.10	19.85
33	1194.0	3.32	39.61	1118.5	3.09	34.51
48	432.0	3.54	15.30	424.3	3.66	15.52
36	432.7	3.28	14.20	410.2	3.34	13.72
Total	**3301.9**	**3.52**	**116.08**	**3179.3**	**3.45**	**109.60**

TABLE VIII.—Summary of Production in Second Trial

Periods	Lbs. of Milk Produced	Percent of Butterfat	Pounds of Butterfat
Soybean periods	6104.9	3.52	214.72
Alfalfa periods	6078.9	3.47	211.22
Difference in favor of Soybean Period	**26.0**		**3.50**

TABLE IX.—Weights of Cows in Second Trial

Lot 1:

Herd No. of Cows	Weight at Beginning of Test	Weight at End of First Period	Gain (or Loss) in Wt. During First Period	Wt. at End of Second Period	Gain (or Loss) in Wt. During Second Period
50	995	1000	5.0	1000	0.0
4	1437	1410	−27.0	1440	30.0
34	1365	1350	−15.0	1370	20.0
43	1015	1000	−15.0	1030	30.0
47	1210	1205	− 5.0	1240	35.0
Total	**6022**	**5965**	**−57.0**	**6080**	**115.0**

Lot 2:

14	940	930	−10.0	950	20.0
16	1495	1530	35.00	1510	−20.0
33	1190	1180	−10.0	1180	0.0
48	1085	1105	20.0	1130	25.0
36	1185	1195	10.0	1210	15.0
Total	**5895**	**5940**	**45.0**	**5980**	**40.0**

TABLE X.—Summary of Weights in Second Trial

Periods	Weight at Beginning of Test	Weight at End of Test	Gain or Loss
Soybean periods	11860	12020	160
Alfalfa periods	11962	11945	−17
Difference in favor of soybean periods			**177**

Tables VII, VIII, IX, and X show that the five cows in Lot 1, while being fed alfalfa hay during a 21-day period, produced 2899.6 pounds of milk containing 101.62 pounds of butterfat; had an average butterfat test of 3.50 percent; and lost 57 pounds in weight. The same five cows, while being fed soybean hay for a similar period, produced 2803.0 pounds of milk containing 98.64 pounds of butterfat; had an average butterfat test of 3.52 percent; and gained 115 pounds in weight.

The five cows in Lot 2, while being fed alfalfa hay during a 21-day period, produced 3179.3 pounds of milk containing 109.60 pounds of butterfat; had an average butterfat test of 3.45 percent; and gained 40 pounds in weight. The same five cows, while being fed soybean hay for a similar period, produced 3301.9 pounds of milk containing 116.08 pounds of butterfat; had an average butterfat test of 3.52 percent; and gained 45 pounds in weight.

Bringing together the results from both lots we find that the ten cows, while being fed alfalfa hay during a 21-day period, produced 6078.9 pounds of milk containing 211.22 pounds of butterfat; had an average butterfat test of 3.47 percent; and lost 17 pounds in weight. The same ten cows, while being fed for a similar length of time on soybean hay, produced 6104.9 pounds of milk containing 214.72 pounds of butterfat; had an average butterfat test of 3.52 percent; and gained 160 pounds in weight.

SUMMARY OF BOTH FEEDING TRIALS

The following table gives a summary obtained by bringing the results of both trials together.

TABLE XI.—Summary of Production in Both Trials

Periods	Pounds of Milk	Percent of Butterfat	Pounds of Butterfat
Soybean periods	11,716.4	3.62	424.68
Alfalfa periods	11,651.8	3.60	419.26
Difference in favor of soybean periods	**64.6**		**5.42**

TABLE XII.—Summary of Body Weight in Both Trials

Periods	Weight at Beginning	Weight at End	Gain or Loss
Soybean periods	23277	23427	150
Alfalfa periods	23272	23250	−22
Difference in favor of soybean periods			172

Tables XI and XII show that by bringing together the results of the two trials, the 20 cows fed for 21 days on alfalfa hay and the basal ration produced 11,651.8 pounds of milk and 419.26 pounds of butterfat; had an average butterfat test of 3.60 percent; and lost 22 pounds in weight.

The same 20 cows fed for 21 days on soybean hay and the basal ration produced 11716.4 pounds of milk and 424.68 pounds of butterfat; had an average butterfat test of 3.62 percent; and gained 150 pounds in weight.

These results show a difference of 64.6 pounds of milk and 5.42 pounds of butterfat in favor of the cows fed soybean hay. The cows fed soybean hay also gained 172 pounds more in weight than did those on alfalfa hay. These two feeding trials indicate that good soybean hay is superior to good alfalfa hay in the production of milk and butterfat and also in the maintenance of body weight of milk cows.

SUMMARY OF RESULTS

1.—Twenty cows fed on soybean hay along with a basal ration for 21 days produced 64.6 pounds of milk and 5.42 pounds of butterfat more than did the same 20 cows fed for the same period with alfalfa hay and the same basal ration.

2.—The 20 cows fed soybean hay and the basal ration gained a total of 150 pounds in weight during the 21-day period, while the same 20 cows fed alfalfa hay and basal ration lost a total of 22 pounds in weight.

3.—Feeding trials herein described indicate that good soybean hay is superior to alfalfa hay as a feed for milk and butterfat production and for maintenance of body weight of milk cows.